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ABSTRACT

This brief paper considers ways in which people with sensory impairments can benefit from the assistive technology available with computers. Assistive technology practitioners are urged not to focus on the disability, but on the individual's abilities and the tasks to be performed. Explanations of the major sensory disability areas precedes descriptions of computing tools that have been used effectively by this population. For visual impairments, these include enlarged monitor displays, screen enlargement technology plus a scanner (to magnify printed text), speech and/or Braille output systems, screen reader software, refreshable Braille displays, and dedicated Web browsing software that incorporates speech and/or large print. For hearing impairments, computer access is simpler but is complicated by system-generated beeps (which can be changed to visual displays) and the increasing use of streaming media. For individuals with loss of sensitivity in hands and/or fingers due to peripheral neuropathy or other causes, suggestions include speech input software. The paper also lists contact and other information resources associated with Project DO-IT at the University of Washington. (DB)

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Working Together: Computers and People with Sensory Impairments

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DO-IT

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Working Together: Computers and People with Sensory Impairments

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Th e appearance of personal computers twenty years ago heralded new education and employment opportunities for people with disabilities, including those with sensory impairments. Because sound was rarely used, people with hearing impairments experienced few limitations in operating the early personal computers. Not long after the introduction of the personal computer, software and hardware systems for reading screen text out loud were developed for people with visual impairments.

As computers and operating systems have become increasingly sophisticated, adapting computers for use by people with sensory impairments has posed increasing challenges. The advent of graphical interfaces (e.g., Microsoft Windows™ and Macintosh OS™) complicates computer access for people who cannot see the screen, since their speech output systems are designed to read text. Multimedia output that uses audio is not accessible to those people who cannot hear. And people who cannot feel a keyboard cannot type effectively. Fortunately, specialized hardware and software can make computer systems usable by anyone with a sensory impairment.

A person with a sensory impairment has reduced ability or lack of ability in using one or more of three senses – vision, touch, and hearing. The effects of a sensory impairment can range from slight to complete loss of ability to use the sense. It may have a mild or severe impact on daily living. Sensory impairments may be present along with other disabilities such as mobility impairments or learning disabilities.

Visual impairments include low vision and blindness. Low vision is used to describe a loss of visual acuity while retaining some vision. It may be combined with light sensitivity and can vary in its effect. Some people with visual impairments have uniform vision loss. Others might have visual field limitations that result in tunnel vision or alternating areas of total blindness and vision. Some people experience loss of color vision. "Blindness" usually refers to a complete lack of vision. People who are considered "legally blind" may have some useful vision.

Hearing impairments include partial or complete hearing loss. People who are deaf have no useful hearing ability.

Nerve damage associated with diabetes may result in Peripheral Neuropathy. This condition is manifested in numbness or a lack of sensitivity in limbs, including fingertips.

Sometimes it is obvious that a person has a sensory impairment – for example, a person who uses a guide dog. Other disabilities are less apparent. For example, someone who is deaf or who has Neuropathy may have no obvious impairment. Someone with a sensory impairment may not require any special technology, while others require significant enhancements to a standard computer in order to access all features.

It is useful for assistive technology practitioners to know about specific disabilities and how they might affect successful computer use, but it's not essential to be a disability expert. It is less important to know how a sensory impairment was acquired than it is to know what abilities a person has and what tasks he needs to perform.

While the use of assistive technology does not remove a sensory impairment, it can remediate its effects so that a person is able to use a computer with full or nearly full functionality. With appropriate computing tools and well-defined strategies for their use, the person with a sensory impairment is able to demonstrate and apply her knowledge.

The person with a sensory impairment should play a key role in determining her goals and needs in selecting her adaptive technology. Once basic tools and strategies are initially selected, they can be "test driven," discarded, adapted, and/or refined. The end user should ultimately determine what works best. The appropriateness of specific adaptive technology for a person with a sensory limitation is usually easy to determine after a brief trial period.

Following are descriptions of some computing tools that have been used effectively by individuals with sensory impairments. This list is not exhaustive; people with sensory impairments and the adaptive technology practitioners should consider other approaches as well. New hardware and software is constantly under development and promises to continually improve access options.

Visual Impairments

The most common accommodation for a computer user with a visual impairment is to enlarge the display of a monitor. This accommodation is accomplished using screen enlargement software. Various screen enlargement packages offer a variety of features. The most popular features enlarge the display from 2 to 16 times the normal view and invert screen colors for those who are sensitive to the usual display of white text on a black background. Some enlargers also incorporate speech output to reduce the strain associated with reading large blocks of text. Commonly used enlargement software includes ZoomText Xtra™ (Ai Squared), Magnum™ (Artic), MAGic™ (Henter Joyce), and Lunar™ (Dolphin Access Systems). Freeware and shareware products are also available via the Screen Magnifiers homepage listed in the resources section.

Screen enlargement technology combined with a scanner can be used to magnify printed text. Once a page is scanned using a standard desktop scanner, the results are displayed in large print on the computer screen. Dedicated devices such as closed circuit TVs (CCTVs), also called video magnifiers, magnify printed materials, photographs, and other objects.

People who are blind access computer output with speech and/or Braille output systems. Speech output is the most popular form of access. A variety of products have been created for working with the Microsoft Windows™ operating system. Most people who are blind use a standard keyboard as an input device, since using a mouse pointer requires accurate eye-hand coordination. Screen reader software uses pre-defined key combinations for review and navigation of the computer screen and is usually compatible with most standard software, including word processing, Web browsing and electronic mail. Examples include, but are not limited to, HAL™ and SuperNova™ (Dolphin Access Systems), JAWS™ for Windows (Freedom Scientific), Window Bridge™ (SYNTHAVOICE), outSPOKEN™ (Alva Access Group), and Window-Eyes™ (GW Micro). People who are blind using a Macintosh are limited to outSPOKEN™.

Refreshable Braille displays are devices that echo information from the screen to a panel with Braille cells. Within the cells are pins that move up or down based on the text transmit-

ted. Braille displays can provide very effective accommodations for users who require precise navigation and editing, such as when creating computer program code that isn't pronounced well with speech. Displays such as the BRAILLEX™ (Papenmeier) and Delphi™ (Alva Access Group) also provide navigation and orientation information to the computer user who is blind.

For novice screen reader users who need access to the World Wide Web, consider dedicated Web browsing software that incorporates speech and/or large print. These browsers ease the process of navigating complicated Web sites, and simplifies Web searching as well as reading of Web sites. Home Page Reader™ (IBM) and Connect Outloud™ (Freedom Scientific) are two of the many examples of this kind of software.

Hearing Impairments

There are few adaptations available (or necessary) for people with hearing impairments in using standard computer productivity software. Sound is used little in mainstream applications such as word processing or e-mail and, when it is used, there is often a visual alternative. Built-in operating system features found in the control panels of Windows software and the Macintosh computer provide visual displays for system-generated beeps.

The increasing use of streaming multimedia is a concern for those who can not hear. Content developers rarely include captioning in video presentations, nor do they transcribe the audio into text. Resources from the National Center for Accessible Media (NCAM) and Microsoft are available for content developers to add captioning to streaming video.

Limited Sensitivity

Loss of sensitivity in hands and/or fingers due to Peripheral Neuropathy or other causes can make it difficult or impossible to use a standard keyboard and mouse. People with this type of sensory impairment can benefit from the use of speech input software such as NaturallySpeaking™ (Dragon Systems) or Voice Xpress™ (Lernout & Hauspie) to control a computer and enter text. Because Neuropathy may be accompanied with vision loss, use of speech output may also be required. JawBone™ (Next Generation Technology) is middleware – software that serves as a go-between for two other programs, that allows JAWS screen reading software to work with Dragon NaturallySpeaking.

Videotape

A ten-minute videotape, *Working Together: Computers and People with Sensory Impairments*, demonstrates key points summarized in this handout. It may be purchased by sending $25 to DO-IT. Contact DO-IT for a list of more than 20 other videotapes that may be of interest. Permission is granted to reproduce DO-IT videotapes for educational, non-commercial purposes as long as the source is acknowledged.

Resources

For more information about sensory impairments and possible computer accommodations, consider the following Web sites:

- Ai Squared: *http://www.aisquared.com/*
- Alva Access Group: *http://www.aagi.com/*
- Artic: *http://www.artictech.com/*
- Dolphin Access Systems: *http://www.dolphinusa.com/*

- Dragon Systems: *http://www.dragonsys.com/*
- Freedom Scientific: *http://www.freedomscientific.com/*
- GW Micro: *http://www.gwmicro.com/*
- IBM: *http://www-3.ibm.com/able/*
- Lernout & Hauspie: *http://www.lhs.com/*
- Microsoft SAMI: *http://www.microsoft.com/enable/sami/*
- National Center for Accessible Media (NCAM): *http://ncam.wgbh.org/*
- Next Generation Technologies: *http://www.ngtvoice.com/*
- Papenmeier: *http://www.papenmeier.de/*
- The Neuropathy Association: *http://www.neuropathy.org/*
- The Screen Magnifiers Homepage: *http://www.magnifiers.org/*

Additional publications regarding the use of electronic and information technology by people with disabilities can be found at *http://www.washington.edu/doit/Brochures/Technology/*. Select *Disability-Related Resources on the Internet* for a comprehensive list of discussion lists and Web sites.

To locate technical assistance centers in your state or region, consult *http://www.resna.org/taproject/at/statecontacts.html* or *http://www.adata.org/dbtac.html*, respectively.

Grants and gifts fund DO-IT publications, videotapes, and programs to support the academic and career success of people with disabilities. Contribute today by sending a check to DO-IT, Box 355670, University of Washington, Seattle, WA 98195-5670.

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About DO-IT

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